

DOCUMENT RESUME

ED 154 064

95

UD 018 083

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TITLE Executive Summary. Instructional Dimensions Study, 1976-1977.
INSTITUTION Kirschner (E.J.) and Associates, Washington, D.C.
SPONS AGENCY National Inst. of Education (DHEW), Washington, D.C.
Educational Equity Group. Compensatory Education Div.
PUB DATE Sep 77
CONTRACT 400-76-0060
NOTE 29p.; For related documents, see UD 018 084 - 087

EDRS PRICE MF-\$0.85 HC-\$2.06 Plus Postage.
DESCRIPTORS *Academic Achievement; *Compensatory Education Programs; Elementary Education; Grade 1; Grade 3; Individualized Instruction; *Mathematics; Motivation; *Program Effectiveness; Program Evaluation; *Reading

IDENTIFIERS *Elementary Secondary Education Act Title I; *Instructional Dimensions Study

ABSTRACT

This one year field study of the effects of instructional practices and teacher characteristics on student achievement in and attitudes toward reading and math at the first and third grade levels involved the study of individualized instructional practices, and (2) instructional settings used in these grades. Also examined were the relationships of opportunity to learn, motivators, instructional events, teacher background and costs. In this study characteristics of classroom instruction were categorized in five ways: (1) individualization, (2) opportunity (3) motivators, (4) instructional events, and (5) teacher background. As one of eight volumes, this volume of the Instructional Dimensions Study is also part of the Compensatory Education Study and as such it is an attempt to gather data which describes the way ESFA Title I funds are used nationally. (Author/AM)

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KIRSCHNER ASSOCIATES, INC.

INSTRUCTIONAL DIMENSIONS STUDY

1976-1977

EXECUTIVE SUMMARY

Hugh Poynor
Principal Investigator

Contract No. NIE 400-76-0060

National Institute of Education
Educational Equity Group
Compensatory Education Division

U. S. Department of Health, Education, and Welfare

September, 1977

Washington, D.C.

The findings of this Study are those of the Contractors and do not necessarily reflect the views of the National Institute of Education and the U. S. Department of Health, Education, and Welfare or any other agency of government.

UD018083

ACKNOWLEDGEMENTS

The Instructional Dimensions Study reports are the products of intensive efforts undertaken during a 19-month period, beginning in March, 1976. While many persons have contributed greatly to the success of the Study, we want to extend special recognition to the following persons:

- Classroom and compensatory education teachers, who generously gave their time to provide detailed information on their teaching practices
- Principals and staff, who allowed full access to the schools, generously supported Study activities, and provided information on instructional programs
- School district administrators, who willingly agreed to participate in the Study, provided full support to staff members, and opened their records to the Study
- Students, who continued with their studies during videotaping and completed the achievement tests and attitude scales
- Local Site Coordinators, who conducted the field work in an exemplary manner and who ably represented the Study in each school district
- Project Officers at the National Institute of Education, who provided understanding as well as supervision and who patiently waited for the findings.

To each of you, the staff for the Instructional Dimensions Study says,
"Thank you."

FOREWORD

This report is one of eight volumes which describe the findings and procedures of the Instructional Dimensions Study. The Study was funded by the National Institute of Education (NIE) as part of the Compensatory Education Study, a comprehensive research program conducted in response to a mandate by the U.S. Congress in the Education Amendments of 1974. The findings of the comprehensive study are to be reported to Congress prior to its deliberations in 1977-1978 regarding the extension of the Elementary and Secondary Education Act.

NIE conceived four main themes for addressing the issues of concern to Congress. The themes are Student Development, Services to Children, Funds Allocation, and Administration of Compensatory Education Programs. The Student Development section includes syntheses of previous evaluations of reading and mathematics programs, studies of alternative designs for delivery of compensatory education, and the present study of instruction, the Instructional Dimensions Study. This Study is designed both to gather data on program effectiveness in reading and mathematics and to complement the NIE National Survey of Compensatory Education, which describes the ways Title I funds are used nationally.

The Instructional Dimensions Study is an in-depth assessment of the relationships between selected instructional constructs and students' achievement. These constructs, as measured by the present Study, are briefly defined below.

INDIVIDUALIZATION: Individualized instruction is defined as the use of the following instructional strategies:

- Matching students to curriculum levels by use of pretests
- Matching students to curriculum levels by use of mastery tests
- Testing practices
- Assignments and grouping practices
- Use of alternative learning routes for students who have difficulty learning skills
- Sequencing and pacing of students through instructional materials.

OPPORTUNITY: Opportunity to learn has two aspects, quantitative and qualitative. The quantitative aspect is basically the amount of time available for learning. The qualitative aspect is the overlap between what is taught and what is assessed on the tests used to measure student learning.

MOTIVATORS: Motivational factors reflect both interpersonal classroom behaviors and curricular features that are hypothesized to encourage and support learning.

INSTRUCTIONAL EVENTS: This construct includes the quantity of interactions devoted to management and to cognitive teaching of individuals, small groups and the whole class; and the nature of teacher interactive behaviors with students.

TEACHER BACKGROUND: Teacher characteristics measured by this construct include the number of years teaching at the same school, highest degree earned, and the number of hours of training (identified according to training activities and content categories) completed during the past three years.

These five constructs are the elements of the Instructional Dimensions Model. They were essentially drawn from the work and experience of William Cooley and Gaea Leinhardt at the Learning Research and Development Center at the University of Pittsburgh, Pennsylvania. The data for all elements of the Study were collected through interviews, videotape recordings, and analysis and transcription of printed materials. In addition, the Study collected information on instructional settings for compensatory education, costs, services provided by school districts, and the criteria used by districts to determine eligibility and participation for school buildings and students in compensatory education programs.

Classrooms participating in the Study were selected according to three primary dimensions: reported degree of individualization, instructional setting, and neighborhood economic status. Schools selected for participation in the Study were required to have instructional programs that had been in operation for at least one year, and

regular classroom teachers were required to have had at least one year of teaching experience in the current instructional program. The Study reflects a focused interest in the effectiveness of individualized instructional practices, as defined by the Study Model and as found within the sample of classrooms, but not in assessing the results of these practices at the national level.

The analysis samples were obtained from 90 school buildings in 14 school districts, with approximately 200 classroom teachers, 170 compensatory education teachers, and 4,300 students. Pretests of student achievement and attitudes were conducted in September and early October, 1976, and posttests were administered in April and early May, 1977. Data analyses were conducted over instructional units (based on the teacher or unique pair of teachers providing instruction to a subset of students within a classroom) for first grade reading, first grade math, third grade reading, and third grade math.

The reports are organized into two series. The Final Reports of the Instructional Dimensions Study are *Executive Summary* and *Study Findings*. Six Supporting Reports provide detailed explanations of the procedures followed by the Study team: *Curriculum Analysis Procedures*, *Data Collection Management*, *Program Cost Analysis*, *School Relations*, *Video Data Documentation*, and *Study Instruments and File Documentation*.

The analysis of the data, reported in the *Executive Summary* and *Study Findings*, was conducted during July, 1977. The 17 months available for the overall conduct of the Study allowed sufficient time for project planning, data collection, and the development of the data base. The time available for project analyses did not allow for analytical work beyond the direct investigation of the simple effects of Individualization, Opportunity, Motivators, Instructional Events, Teacher Background, instructional settings, and costs. The results of further analyses of the data will be presented in future reports. These reports will also include analysis of additional testing to be conducted in fall, 1977, with a sample of students from the present Study analysis samples.

A consortium headed by Kirschner Associates, Inc., of Washington, D.C., was funded by NIE in March, 1976, to conduct the Instructional Dimensions Study. Other members of the consortium were Education TURNKEY Systems, Inc., of Washington, D.C.; and the Learning Research and Development Center of Pittsburgh, Pennsylvania. Steiger, Fink and Kosecoff, Inc., of Los Angeles, California, and McLean, Virginia, was involved in the initial design and development of the curriculum analysis procedures.

Staff members who performed important roles in the implementation of the study design, collection and processing of the data, and in the preparation of the Final and Supporting Reports of the Study include: Blair Curry, project manager; Morris Peterson, study editor and data collection manager; Mary Ella Brady, senior analyst and regional coordinator; Chuck Clinton, analyst and regional coordinator; Ann Dargis, regional coordinator; Donald Johnson, computer operator; Linda Ingison, research associate; and Alan Pittaway, project administrator -- all of Kirschner Associates, Inc.;

Also, Charles Blaschke, school relations manager; John M. Sweeney, data analysis manager; Reynold P. Stimart, video trainer and analyst; and Lee H. Poynor, curriculum analysis manager -- all of Education TURNKEY Systems, Inc.

September, 1977

Hugh Poynor
Principal Investigator

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EXECUTIVE SUMMARY
INSTRUCTIONAL DIMENSIONS STUDY

BACKGROUND OF THE STUDY

The Education Amendments of 1974 (Public Law 93-380) mandated the National Institute of Education (NIE) to conduct a comprehensive study of compensatory education and report its findings to the Congress prior to deliberations regarding the extension of the Elementary and Secondary Education Act of 1965. Because of the specific interest of Congress in instructional effectiveness, NIE was requested to conduct a study which would include: "an analysis of the effectiveness of methods and procedures for meeting the educational needs of children, including the use of individualized written education plans for children...."

NIE conceived four main themes for addressing the issues of concern to Congress. The themes are Student Development, Services to Children, Funds Allocation, and Administration of Compensatory Education Programs. The present Study is a major part of the Student Development research program. In addition to the Instructional Dimensions Study, other projects include a synthesis of previous evaluations of reading and mathematics programs, studies of alternative designs for delivery of compensatory education, and the NIE National Survey of Compensatory Education. The National Survey is the only component of the NIE study that is nationally representative of school districts and their compensatory education programs.

Because of the complexities inherent in a study of the effectiveness of individualized programs, NIE solicited design submissions from four contractors. The contractors were directed to design a study to assess the effectiveness of individualized instruction as practiced in compensatory education programs in schools. The design submitted by the Learning Research and Development Center (LRDC) was designated by NIE as that to be used as the basis for the present Study.

PURPOSES OF THE STUDY

The Instructional Dimensions Study is a one-year field study of the effects of instructional practices and teacher characteristics on student achievement in and attitudes toward reading and math at the first and third grade levels. The major focuses of the Study are on (1) individualized instructional practices, and (2) instructional settings. Also examined were the relationships of opportunity to learn, motivators, instructional events, teacher background and costs with posttest achievement and attitudes. The time available for analysis of the data did not allow for analytical work beyond the direct investigation of the simple effects of the Study Model elements, dimensions, and cost.

DESIGN

The Instructional Dimensions Model

In the present Study, characteristics of classroom instruction were categorized into five elements: Individualization,¹ Opportunity, Motivators, Instructional Events, and Teacher Background. Classroom instruction is defined in terms of the procedures used to place the student in the curriculum and to monitor his/her progress through the material (Individualization), the patterns of management, cognitive teaching behaviors and characteristics of teacher interactions (Instructional Events), the training and experience of the teachers (Teacher Background), and the factors affecting the student's access to (Opportunity) and inclination to learn (Motivators) the instructional material.

The Study Model is based on the Classroom Process Model used by LRDC. It specifies that the criterion performance -- in this case student achievement in or attitudes toward reading and math -- is a function of initial student performance on the criterion measure and of certain classroom processes that take place in the interval between the

¹ This element was designated "Structure and Placement" in the LRDC design.

assessment of initial performance and the assessment of criterion performance. In addition, the relationships of cost with achievement and the Study Model elements and dimensions were examined. Instructional Setting was used as a blocking variable in order to assess the effects of the Study Model elements in different settings.

Study Model Elements and Dimensions

The data collected consisted of measures (or single variables) that were composited into 18 dimensions, that were in turn grouped according to the five Study Model elements. Exhibit I displays all elements, the dimensions assigned to each element, and the number of measures (both total and the number composited) per dimension. General descriptions of the dimensions, in terms of composited measures only, are given below.

Opportunity. The two dimensions within Opportunity are Amount of Time and Curriculum Overlap. Generally, Amount of Time measures opportunity in terms of available time for learning a subject, class size, classroom stability of enrollment, and student attentiveness to learning tasks. Curriculum Overlap contained one measure of the opportunity for students to learn the skills necessary to answer the items on the posttest. This measure was an average of the number of items on the reading (or math) test that were covered during the school year.

Motivators. The two dimensions within Motivators are Curriculum Motivators and Interpersonal Motivators. Curriculum Motivators refers to how interested students are in the main curriculum materials, how quickly students' work was corrected, and degree of reliance on basic texts, instructional kits, and an instructional system. Interpersonal Motivators contains measures of the use of games, peer tutoring, student self-evaluation, student self-management in seating and working alone, and a rating of the amount of teacher praise.

EXHIBIT I

ELEMENTS, DIMENSIONS, AND NUMBER OF DIMENSIONS
IN THE INSTRUCTIONAL DIMENSIONS STUDY MODEL

<u>Element</u>	<u>Dimension</u>	<u>Measures</u>	
		<u>No. in Study Model</u>	<u>No. Analyzed</u>
OPPORTUNITY	Amount of Time (Available to Learn Subject Matter)	12	7
	Curriculum Overlap	1	1
MOTIVATORS	Curriculum Motivators	12	6
	Interpersonal Motivators	10	7
INSTRUCTIONAL EVENTS	Management Information	4	4
	Cognitive Teaching to Individuals	7	7
	Cognitive Teaching to Small Groups	5	5
	Cognitive Teaching to Whole Class	4	4
	Interactive Behaviors and Experience	15	11
INDIVIDUALIZATION	Matching by Pretests	9	5
	Matching by Mastery	11	7
	Testing Practices	14	9
	Assignments and Grouping	11	9
	Alternative Learning Routes	13	6
	Sequencing and Pacing	6	5
TEACHER BACKGROUND	Teaching at Same School	3	1
	Formal Education	1	1
	Recent Training	16	11
COST	Program Cost	7	7
SETTING	Pullout	1	1
	Regular	1	1

Instructional Events. Instructional Events consists of five dimensions -- Management Information (frequency per hour of teacher instructions to students), Cognitive Teaching to Individuals (frequency per hour of one-to-one instruction), Cognitive Teaching to Small Groups (frequency per hour of small group instruction), Cognitive Teaching to Whole Class (frequency per hour of whole class instruction), and Interactive Behaviors and Experience (the nature of the interactions between the teacher and students, and the total years of teaching experience).

Individualization. There are six dimensions of the Individualization element. The first dimension, Matching by Pretests, consists of the procedures used by the teacher to place students in the curriculum at the start of the school year. The Matching by Mastery dimension measures the presence of curriculum mastery tests as well as the procedures used by the teacher to assess overall learning. The Testing Practices dimension measures the testing procedures of teachers in a more direct manner than the two previous dimensions because it includes data on testing practices and tests actually used in classrooms. The Assignments and Grouping dimension relates to assignment procedures, the size of the groups in which students receive instruction, and the frequency of regrouping. The Alternative Learning Routes dimension measures the procedures used by the teacher when students encountered difficulty learning skills, as well as reliance on a management system. The last dimension, Sequencing and Pacing, identifies how instruction is sequenced, the presence of self-pacing for students, and the extent to which the teacher creates supplemental materials to improve sequencing.

Teacher Background. There are three dimensions within Teacher Background -- Teaching at Same School, consisting of the total number of years of teaching experience at the Study school; Formal Education, consisting of the highest degree obtained; and Recent Training, consisting of measures of the total number of hours of training within the past three years in teaching techniques for reading or math and for compensatory education.

Other Elements

Cost. Cost refers to the expenses of the resources allocated by the local district and by compensatory education funds to the reading or math program. Total costs (personnel and non-personnel) were determined per program as well as by six functions -- regular instruction, compensatory education instruction, program planning, program training, program decision-making, and program administration.

Instructional Setting. Two types of setting were used: Regular, in which students received instruction only from the regular teacher in the subject area; and Pullout, in which students received instruction from the regular teacher *and* were pulled out of the regular classroom to receive compensatory education instruction.

Descriptive Variables. Two descriptive elements were used, primarily to compare the characteristics of the sample to the NIE National Survey of Compensatory Education in order to determine the representativeness of the Study sample. Eligibility/Participation reported the criteria used by the school districts to select eligibles and participants in compensatory education programs. District Services measured variables such as district assistance to schools as well as planning and coordination procedures.

Unit of Analysis

The unit of analysis for the Study was the instructional unit, a subaggregate or group of students within a classroom who received reading or math instruction from the same teacher or a unique pair of teachers. Students within a classroom were divided into two categories or units: (1) Regular, or those students receiving all reading or math instruction within the regular classroom, and (2) Pullout, those who received regular reading or math instruction within the regular classroom *plus* compensatory education instruction in reading

or math outside the regular classroom. Thus, the data for Regular Instructional Units represent the characteristics of one teacher, while data for Pullout Instructional Units represent the characteristics of a unique combination of two teachers (e.g., the regular classroom reading teacher *and* the compensatory education reading teacher). The total analysis sample of instructional units was called the Full sample for each subject/grade combination. The Full sample was formed by combining all Regular and Pullout Instructional Units for a particular subject and grade.

Pullout units, as described above, consisted solely of compensatory education participants in reading and math. Most Regular units consisted of students who did not receive compensatory education instruction. However, a few compensatory education status students (approximately 10 percent) were included in the Regular samples. This generally occurred when the compensatory education program involved an aide in the regular classroom or tutorial-type instruction.

Sample Description

A purposive and not representative sample of classrooms was selected for the Study in order to obtain variation on the degree of individualization, setting for compensatory education instruction, and neighborhood economic status. All classrooms in the Study were participants in a continuing program of instruction. That is, the instructional program at the school had been in operation at least one year prior to the Study, and regular classroom teachers had at least one year of experience teaching in the program. Reading and math were selected as the subject areas of interest because they are the subjects most commonly supported by compensatory education funds. The first grade was selected in order to assess the effects of instructional practices as early as possible, and because it is a critical year for beginning reading. The third grade was selected to provide a basis of comparison.

Data Collection and Analysis Samples

Achievement tests and attitude scales were administered in the fall of 1976 and in the spring of 1977 to approximately 5,000 first grade students and 5,000 third grade students. The majority of the compensatory education students in the Study were in Title I programs, with some students participating in other compensatory education programs, such as the Emergency School Aid Act and State compensatory education programs. Fall and spring interviews were conducted with approximately 200 first grade reading and math teachers, 200 third grade reading and math teachers, and 300 compensatory education teachers serving first and third grade Study students. The majority of regular classroom teachers at a grade level taught both reading and math to Study students. Teachers assisted in the completion of various fact sheets designed to provide more detailed information on instructional practices and on the activities of students. In addition, videotapes of reading and math instruction were made of 275 regular classroom teachers and 200 compensatory education teachers (subsamples of the total). Information on program characteristics was collected from principals in the 100 participating school buildings and from program administrators in each of the 14 school districts participating in the Study.

For analysis purposes, the sample was reduced to 103 first grade reading, 92 first grade math, 98 third grade reading, 109 third grade math, and a total of 174 compensatory education teachers. This occurred primarily because of the reduced sample for videotaping, classrooms dropped (due to invalid pretest scores) from the Study, and missing teacher data. The analysis sample was drawn from 90 school buildings in the 14 participating school districts. Approximately 2,000 first grade and 2,300 third grade students were included in the analysis sample classrooms. Inspection of the means and standard deviations for randomly selected measures and for achievement scores suggested that the total sample and the analysis sample had highly similar characteristics.

Descriptive Data on Achievement

Students at both grade levels in reading and math achieved at a rate higher than that expected, according to the national norms of the tests used. The percentile ranks reported in Table 1 for pretest and post-test achievement scores are based upon averages of instructional unit mean raw scores. Study students tended to be further below the national norms of the tests at pretesting as compared to posttesting. Third grade students were further below the national norms of the tests, and students tended to score lower in math than in reading.

Descriptive Data on Attitudes

Study students expressed a liking for most aspects of reading/ language arts and math activities at the time of pretesting, and, on the average, gained only slightly in their attitude scores. This was true for both compensatory and noncompensatory education students.

Representativeness of the Sample

To determine the national representativeness of the Study sample, selected characteristics of the compensatory education programs of the school districts participating in the present Study were compared with the information collected by the NIE National Survey of Compensatory Education. The Study sample contained 14 school districts, 100% of which received Title I funds (vs. 90% nationally) and in which 80% of eligible students were served (vs. 66% nationally). For the compensatory education teachers in the Study, 44% had a master's degree (vs. 30% nationally). Average class size of the compensatory education classes was comparable, as was the percent of instructional time during the school day that was devoted to compensatory education in math, with students in the current Study having a slightly lower percent of time for reading.

TABLE 1

PRETEST AND POSTTEST ACHIEVEMENT SCORES
IN PERCENTILE RANKS¹ FOR THE PULLOUT, REGULAR
AND FULL SAMPLES IN THE FOUR SUBSTUDIES

	First Grade Reading			First Grade Math		
	<u>Pullout (N=87)</u>	<u>Regular (N=94)</u>	<u>Full (N=181)</u>	<u>Pullout (N=21)</u>	<u>Regular (N=91)</u>	<u>Full (N=112)</u>
Pretest Percentile	26	48	37	24	39	33
Posttest Percentile	40	53	47	27	56	27

	Third Grade Reading			Third Grade Math		
	<u>Pullout (N=89)</u>	<u>Regular (N=89)</u>	<u>Full (N=178)</u>	<u>Pullout (N=46)</u>	<u>Regular (N=108)</u>	<u>Full (N=154)</u>
Pretest Percentile	16	44	31	7	26	20
Posttest Percentile	27	49	38	17	35	31

¹Percentile ranks are based upon average raw scores of the instructional unit means within a sample.

Analysis Strategies

The data were gathered at the classroom level from teachers and students. For a classroom divided into more than one instructional unit, the regular teacher data were duplicated across each appropriate instructional unit. For the Pullout units, in which data from two teachers (regular and compensatory education) were available, the data from each teacher were weighted, based upon duration of instruction, and averaged.¹

A data reduction process employed by LRDC over the past few years was employed to reduce the number of measures. This process combined empirical scoring and theoretical *a priori* scoring methods. Forty-eight measures with low variance, sign reversals for the correlation coefficients, and high confounding with the pretest were dropped from the analysis. The remaining 106 measures were standardized, with a mean of zero and a unit standard deviation, using the Full Instructional Units (i.e., all analysis units). This was done separately for each of the four substudies (first grade reading, first grade math, third grade reading, and third grade math). Next, measures for specific dimensions were combined by addition or subtraction, according to the sign associated with each measure, with the resulting value being divided by the number of measures per dimension to form a dimension score. The measures (and their signs) used to form the dimensions were identical for the four substudies.

The statistical procedure employed was commonality analysis, in which the amount of explained variance in the criterion that is uniquely associated with each predictor is identified, as well as the variance associated with combinations of predictors. Commonality analysis operates with regression equations. In this statistical analysis, a specific predictor or set of predictors is entered last, after all other predictors have been entered, to determine the amount or percent of the

¹All analyses of Pullout samples in the current Study are based on weighted averaged data collected from the regular classroom teacher and the compensatory education teacher providing instruction to the students in each Pullout Instructional Unit. One of the follow-up analyses will provide results of commonality analyses of Pullout units, using the data only from the compensatory education teacher.

total variation¹ uniquely associated with the specific predictor or set of predictors. Significance tests are computable only for unique contributions. A p level of $<.10$ was used to define significance for unique scores in the achievement and attitude commonality analyses.

In the current Study, the regression equations contained 20 predictors -- the 18 Study Model dimensions and two initial performance measures (raw score means and standard deviations). The criteria were posttest raw scores on the achievement and attitude tests in reading and math. Two procedures were used to group predictors into sets. In the first procedure, the 18 Study Model dimensions were grouped into one set and the two initial performance measures into a second set in order to answer the following research question:

- How much of the variation in the criterion can be uniquely apportioned to the Instructional Dimensions Study Model and to initial performance, and how much is common to both?

In the second procedure, the Study Model dimensions were grouped into five sets, equivalent to the elements of the Study Model, with the sixth set again being the initial performance set, in order to answer the following research question:

- How much of the predictable variation in the criterion can be uniquely apportioned to the five Study Model elements and to initial performance, and how much is common to them?

For the achievement results, the importance of dimensions within elements was investigated by computing the predicted raw score differences

¹ The total possible amount of variation that can be accounted for is always 1.00. Variation accounted for, thus, can range from .00 to 1.00 or from 0% to 100%. For example, if the Study Model uniquely accounts for .20 of the variation, it can also be said that the Study Model uniquely accounts for 20% of the total variation.

in posttest achievement for a one unit larger value of each dimension. For a particular dimension, the predicted difference was determined by multiplying the b weight from the sample regression equation by the standard deviation of the dimension for the particular sample of interest. The research question addressed by these computations was:

- For elements that are significant as unique sources, which of the dimensions within the element appear to be the most important?

For the investigations of cost, statistical procedures were employed to test the significance of the differences in cost. Zero-order correlations between cost variables and achievement (with pretest means partialled out) were used to establish the relationships between the cost variables and achievement, and cost and the Study Model dimensions. A p level of $<.05$ was used to establish significance for all correlation coefficients in the cost analyses.

ACHIEVEMENT RESULTS

Study Model and Initial Achievement

The results of the commonality analyses with achievement as the criterion for the four substudies and for the samples within a substudy are displayed in Table 2. These analyses address the first research question and, therefore, identify the amount of variation uniquely associated with the Study Model as a whole and with initial achievement, as well as the amount common to both. The following discussions refer to only 10 of the 11 analyses because the third grade math Pullout sample results are not included.¹

¹The first grade math Pullout sample could not be analyzed due to the $N(21)$ as compared to the number of predictors (20). The third grade math Pullout sample is displayed for reader interest but will not be discussed due to the potential unreliability of the results with a sample of that size ($N=46$).

TABLE 2
UNIQUE AND COMMON SOURCES OF VARIATION
FOR THE STUDY MODEL AND INITIAL
ACHIEVEMENT FOR THE PULLOUT, REGULAR AND
FULL SAMPLES IN THE FOUR SUBSTUDIES

	First Grade Reading			First Grade Math		
	Pullout (N=87)	Regular (N=94)	Full (N=181)	Pullout ¹ (N=21)	Regular (N=91)	Full (N=112)
Total Unique to Study Model	.256*	.260*	.130**		.314**	.197*
Total Unique to Initial Achievement	.097**	.080**	.189***		.103**	.177***
Total In Common	.065	.132	.123		.094	.068
Total RSQ	.418**	.474***	.443***		.511***	.441***
	Third Grade Reading			Third Grade Math		
	Pullout (N=89)	Regular (N=89)	Full (N=178)	Pullout ² (N=46)	Regular (N=108)	Full (N=154)
Total Unique to Study Model	.163*	.066	.051*	.327	.099*	.077*
Total Unique to Initial Achievement	.200***	.419***	.445***	.096*	.380***	.420***
Total In Common	.257	.277	.275	.204	.240	.224
Total RSQ	.619***	.762***	.770***	.627*	.719***	.721***

* p < .10

* p < .05

** p < .01

*** p < .001

¹ No results are presented for the first grade math Pullout sample because the number of instructional units (N=21) was too small to analyze.

² For the third grade math Pullout sample, results may be unreliable due to the small sample size (N=46) as compared to the number of predictors (20).

The Study Model elements and initial achievement predicted highly significant amounts of posttest achievement variation in the 10 analyses, ranging from .42 (or 42% of the total variation) in the first grade reading Pullout sample to .77 (or 77% of the total variation) in the third grade reading Full sample. Approximately .25 more of the variation was predictable in the third grade as compared to the first grade. Generally, slightly more variation was predictable in the Regular samples as compared to the Pullout samples, while the amounts in reading and math for a grade level were similar.

Instructional practices and teacher characteristics (instructional environment), as measured by the Study Model, were uniquely associated with significant amounts of variation in 9 of 10 analyses. Initial achievement was significant as a unique source in all analyses. For the Pullout or compensatory education students in first grade reading, the Study Model was uniquely associated with two and a half times as much variation as initial achievement. In the third grade reading Pullout sample, initial achievement was slightly more important than the Study Model. For the Regular or noncompensatory education students, the Study Model uniquely contributed about three times more variation than initial achievement in the first grade, while in the third grade initial achievement contributed about five times more variation than the Study Model. For the Full samples, the two sources were somewhat equal in importance in the first grade, but in the third grade the variation contributed by initial achievement was about seven times larger than that contributed by the Study Model.

The amounts unique to the Study Model in first grade reading were almost identical in the two settings -- that is, for the Pullout and Regular samples. For the third grade reading samples, however, about two and a half times more unique variation was associated with the Study Model in the Pullout as compared to the Regular sample.

The amounts of variation uniquely associated with initial achievement in the first grade reading Pullout and Regular samples were almost identical. In third grade reading, however, slightly more than twice as much variation was uniquely associated with initial achievement in the Regular sample as compared to the Pullout sample.

There was also more confounding in the third grade, as compared to the first, between initial achievement and instructional practices and teacher characteristics, as measured by the Study Model. This occurred for both reading and math, and for the Pullout and Regular samples.

The Effects of Study Model Elements

The results of the commonality analyses addressing the second research question, that is, the separate effects of the five Study Model elements and initial achievement, are displayed in Table 3. In these analyses in which the Study Model dimensions were grouped by element, three of the Study Model elements were significant as unique sources in only 1 of 10 analyses -- Motivators, Instructional Events, and Teacher Background. Generally, these three elements were uniquely associated with .01 or less of the variation and as common sources, .02 or less. As determined in the Study, they are not important predictors of reading or math achievement for first or third grade compensatory or non-compensatory education students.

The Opportunity element was significant as a unique source in all first grade analyses. At that grade it was uniquely associated with an average of .07 of the total posttest variation for both compensatory education and noncompensatory education students, as well as all students considered together. In addition, it was confounded with other Study Model elements and with initial achievement, with the largest confounding occurring as a common source with initial achievement. The common source of Opportunity and initial achievement was associated with an average of .05 of the total posttest variation. For the first grade, the most important dimension within this element was Curriculum Overlap.

In the third grade, the Opportunity element was uniquely associated with approximately .01 or less of the posttest variation and was not significant in any sample. This element is not important as a unique source in the third grade. As a common source with initial achievement, however, the Opportunity element was important in the Regular and Full

TABLE 3

UNIQUE AND COMMON SOURCES OF VARIATION FOR THE STUDY MODEL ELEMENTS AND
INITIAL ACHIEVEMENT FOR THE PULLOUT, REGULAR AND FULL SAMPLES IN THE FOUR SUBSTUDIES

Unique Sources	First Grade Reading			First Grade Math			Third Grade Reading			Third Grade Math		
	Pullout (n=877)	Regular (n=94)	Full (n=181)	Pullout ¹ (n=21)	Regular (n=21)	Full (n=112)	Pullout (n=89)	Regular (n=89)	Full (n=178)	Pullout ² (n=46)	Regular (n=108)	Full (n=155)
Opportunity	.075*	.066*	.048**	.071**	.083**		.013	.010	.006	.008	.007	.008
Motivators	.009	.016	.009	.013	.012		.010	.000	.001	.024	.021*	.008
Instructional Events	.005	.046	.016	.097*	.040		.024	.017	.007	.056	.009	.005
Individualization	.087	.024	.016	.111*	.043		.080*	.023	.027**	.137	.040*	.036*
Teacher Background	.010	.043	.037	.019	.009		.040*	.005	.004	.096	.006	.010
Initial Achievement	.097**	.080**	.189**	.103**	.177**		.280**	.419**	.445**	.096*	.380**	.430**
Common Sources³												
Opportunity and Motivators	.027											
Opportunity and Instructional Events		.023										
Opportunity and Individualization		.021		.036						.021		
Opportunity and Teacher Background										.043		
Opportunity and Initial Achievement	.067	.039	.055	.028	.047			.106	.078	.041	.098	.110
Motivators and Initial Achievement							.029	.034				
Instructional Events and Individualization				-.030						.022		
Instructional Events and Initial Achievement	.024		.024				.021					
Individualization and Initial Achievement		.047	.031	.031	.040		.193	.052	.131	.048	.045	.040
Teacher Background and Initial Achievement							.036	.028			.021	
Opportunity, Instructional Events, and Individualization										.033		
Opportunity, Instructional Events, and Initial Achievement								.042	.041	.029		
Opportunity, Individualization, and Teacher Background										-.037		
Opportunity, Individualization, and Initial Achievement		.020								.049	.091	.047
Opportunity, Teacher Background, and Initial Achievement							.057	.031	.032			
Motivators, Individualization, and Teacher Background										.020		
Motivators, Individualization, and Initial Achievement							-.029					
Instructional Events, Teacher Background, and Initial Achievement										.026		
Individualization, Teacher Background, and Initial Achievement							-.031	-.026		.041		
Opportunity, Individualization, Teacher Background, and Initial Achievement							-.025			-.023		

* p < .10

* p < .05

** p < .01

*** p < .001

¹No results are presented for the first grade math Pullout sample because the number of instructional units (N=21) was too small to analyze.²For the third grade math Pullout sample, results may be unreliable, due to the small sample size (N=46) as compared to the number of predictors (20).³Only those common sources associated with more than .02 of the variation are reported.

samples in reading and math in the third grade. This common source was associated with an average of .10 of the posttest variation, for the common sources shown in Table 3. For the compensatory education students in the Pullout sample in reading, the Opportunity and initial achievement common source was associated with less than .02 of the posttest variation. Therefore, Opportunity does not appear to be important as a unique or as a common source with initial achievement for the compensatory education students in third grade reading.

The Individualization element was uniquely associated with significant amounts of posttest variation in 4 of 5 analyses in the third grade and 1 of 5 in the first grade. In the first grade math Regular sample (the only one in which it was significant as a unique source), Individualization was uniquely associated with .11 of the variation. In the other four first grade samples in which it was not significant as a unique source, it was uniquely associated with an average of .04 of the variation. The common source of Individualization and initial achievement was associated with an average of .04 of the posttest variation for the first grade samples, as shown in Table 3. For compensatory and non-compensatory education students in first grade reading and for the Full sample students in first grade reading and math, the Individualization element is not an important predictor of achievement as a unique source.

In the third grade, however, the amount uniquely associated with this element ranged from .02 to .08. Only in the third grade reading Regular sample was it not significant. As a common source with initial achievement, Individualization was associated with .04 to .19 (an average of .10) of the posttest variation for the sources shown in Table 3. As a unique source, the amount of variation with which Individualization was associated in the third grade reading Pullout sample of compensatory education students was two to four times larger than the amounts with which it was associated in the other third grade samples. As a common source with initial achievement, the variation associated with Individualization in the third grade reading Pullout sample is two to five times larger than this common source in other third grade samples. For the third grade compensatory education students, this

common source accounts for almost .20 of the total variation and is, by far, the largest common source in Table 3.

In the third grade, Matching by Mastery was the most important dimension for reading. For math, Matching by Pretests, Matching by Mastery, and Testing Practices all appeared to be important, with Assignments and Grouping being important only in the Full Sample.

ATTITUDE RESULTS

For the analyses of attitude, the total predictable variation ranged from .15 to .44 and was significant in 7 of 10 samples. (The first and third grade math Pullout samples are not included in this discussion.) The amount of variation uniquely associated with the Study Model ranged from .12 to .16 in 9 of 10 samples and was .24 in the third grade reading Regular sample. The Study Model was not uniquely associated with significant amounts of posttest variation in any of the samples. For that reason, no investigations of the effects of Study Model elements were conducted. Initial attitude was significant as a unique source in 8 of 10 analyses, with the amount ranging from .11 to .21 of the posttest variation. It was not significant for the Pullout and Full samples in third grade reading, in which it was associated with .01 of the variation in both samples. The common source between the Study Model and initial attitude was associated with approximately .05 or less of the variation, revealing little confounding between instructional practices/teacher characteristics and initial attitude.

COST RESULTS

Cost analyses indicated that Pullout programs were significantly more costly than Regular programs, and reading programs more costly than math. First grade reading programs were more costly than third grade programs in the Regular samples, and third grade math programs were more costly than first grade programs in the Pullout samples. A significant positive relationship was observed between total program cost and post-

test achievement mean (with the effects of the pretest removed) only for first grade reading Pullout programs. Compensatory education instruction cost is significantly and positively related to total program cost for both grades for both subjects for Pullout programs.

SUMMARY

According to the results of the current Study, the following summary statements can be made:

- For compensatory education students in reading, instructional environment is more important than initial achievement level in the first grade, but in the third grade they are approximately equal in importance.
- For the noncompensatory education students in reading and math, instructional environment is more important than initial achievement level in the first grade, but in the third grade initial achievement level is much more important.
- For all students, instructional environment and initial achievement together have a higher relationship with posttest achievement in the third grade as compared to the first grade.
- The relationships between instructional environment and posttest achievement are more affected by grade level than by subject area.
- For first grade students, regardless of their initial achievement levels, opportunity to learn is the most important predictor of reading and math achievement.
- For first grade noncompensatory education students, Individualization, as measured in the current Study, is an important predictor of math achievement.
- In the third grade, Individualization, as measured in the current Study, is the most important predictor of achievement, especially for compensatory education students in reading. Its importance at this grade level, however, varied by subject and student initial achievement level.
- The relationships between factors assumed to motivate students, classroom verbal interactions, teacher training and reading and math achievement for first and third grade students are small and nonsignificant in almost all cases.

- The relationship between instructional environment and student attitudes toward reading/language arts and math activities is very small and nonsignificant.
- Program effectiveness can be predicted from program cost data only for first grade reading compensatory education students.
- Further analyses of the data are warranted, given the extensiveness of the data base and given the number of unexplored findings.